Description of a new genus and new species of New World Phlebotominae (Diptera, Psychodidae)

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Abstract. A new genus and new species of Phlebotominae, *Edentomyia piauiensis* (Diptera, Psychodidae) from a cave in Piauí State, Brazil, are described. This new genus belongs to Phlebotomini, but its inclusion in any subdivision of this tribe depends on further study.

Keywords. *Edentomyia* **gen. nov.**; *Edentomyia piauiensis* **sp. nov.**; Phlebotominae; Psychodidae; taxonomy.

INTRODUÇÃO

According to the classification of Galati (1995), Phlebotomini Rondani, 1840 is divided into several subtribes: Phlebotomina, Australophlebotomina Artemiev, 1991, Brumptomyiina Artemiev, 1991, Sergentomyiina Artemiev, 1991, Lutzomyiina Abonnenc & Léger, 1976 and Psychodopygina Galati, 1995. The subtribe Phlebotomina is restricted to the Old World. It represents the earliest ramification in the cladogram and the divergent branch, constituted by the ancestor of Australophlebotomina+, has as synapomorphy which unites this monophyletic group, the presence of horizontal teeth in the female cibarium. Hence, the cibarium of females without these teeth represents a plesiomorphy which, for American sandflies, has been described only for species of Hertigiina Abonnenc & Léger, 1976. However, the absence of the horizontal teeth in the cibarium was observed in male and female of a sandfly species captured in Piauí State, Brazil, besides several other plesiomorphic characteristics; thus, seems that these specimens belong to a new genus and new species which are here described.

MATERIAL AND METHODS

The specimens, after clarification by the method given by Forattini (1973) and mounted on microscope slides in NC medium (Cerqueira 1943) were measured with a Zeiss® eye-piece calibrated according to a standard Zeiss® scale and drawn with the help of an Olympus® drawing attachment. The measurements are given in micrometers, those in parentheses represent the average and standard deviations for the paratypes. The specimens were captured with automatic light CDC trap (Sudia & Chamberlain 1962) from 6:00 p.m. to 6:00 a.m. in a cave. The terminology adopted for the morphological structures, in general, follows McAlpine (1981), but some of these latter (ventrocervical sensillae, setae on the anterior edge of katepisternum and labial sutures), specifically studied in phlebotomines are described following Galati (1995), who although presented them, not drown them, due to the limited size of that short communication. Thus they are here illustrated for the first time. The use of the sign + following a taxon signifies that it refers to the earlier branch of a monophyletic group constituted of three or more taxa, according to a suggestion of Amorim (1982). The types are deposited in the entomological collection of the Centro de Pesquisa René Rachou, Fundação Oswaldo Cruz - Fiocruz, Belo Horizonte, Brazil (CPqRR), Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, Brazil (FSP) and Instituto Oswaldo Cruz- Fiocruz, Rio de Janeiro, Brazil (IOC).

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Edentomyia gen. nov.

Type-species: *Edentomyia piauiensis* **sp. nov.**

Male. Head. Clypeus shorter than the eyes; interocular sutures not united with the interantenal suture; occipital bristles arranged in arrow-head formation; AIII with external ascoid implanted more apical than the internal one or both situated at the same level. AIV with simple and short ascoids, the distal prolongation not reaching the middle of the segment. AV with the papilla present or absent. AXIII without papilla. Palpal formula: 1.2.3.4.5. Palpomere III with Newstead's spines grouping in the basal third and presence of a preapical seta. Palpomere IV with more than five pairs of setae. Cibarium with long chamber, in which only rudimentary lateral teeth are present, absence of pigmented patch and posterior bulge, arch complete. Pharynx unarmed. Labrum-epipharynx short, measuring half of the head length; labial sutures forming a furca.

Cervix. Presence of ventrocervical sensillae.

Thorax. Presence of posalar, proepimeral, upper anepisternal bristles (these some times absent) and setae on the anterior edge of katepisternum; suture between katepimeron and metepisternum long.

Abdomen. Bristles covering the tergites arranged without forming transversal bands; presence of the tergal papillae on some tergites. Terminalia: gonostyle with five spines, two of them apical, the two external spines implanted on the apical 4th and the internal one in the middle of structure; gonocoxite without basal tuft, only sparse setae implanted in the middle; of it; lateral lobe with rounded tip and as long as the gonocoxite; simple and digitiform paramere; conical and long aedeagus; genital filaments with simple tip.

Female. Clypeus shorter than the eyes; interocular sutures not united with the interantennal suture; occipital bristles arranged in arrow-head formation. AIII with external ascoid implanted more apical than the internal one. AIV with simple and short ascoids, the distal prolongation reaching the middle of the segment. AV with the papilla. AXIII without papilla. Palpal formula: 1.2.3.4.5. Palpomere III with Newstead's spines implanted together in the basal third and presence of one preapical seta. Palpomere IV with six pairs of setae. Cibarium with long chamber, in which only rudimental lateral teeth are present, absence of pigmented patch and posterior bulge, arch complete. Pharynx unarmed. Labrum-epipharynx short, measuring a little more than half the length of the head; labial sutures forming a furca. Maxilla: lacinia with the external teeth disposed in a longitudinal row. Hypopharynx with deep apicolateral teeth.

Cervix. Ventrocervical sensillae present.

Thorax. Characters as in the male.

Abdomen. Bristles covering the tergites arranged without forming transversal bands. Terminalia: tergite VIII without bristles. Spermathecae annulated, common duct short and the individual ducts *ca*. 3 x the body length.

Etymology. The name *Edentomyia* alludes to the absence of cibarial armature in both sexes.

Edentomyia piauiensis sp. nov.

(Figs. 1-20)

Holotype (male). Total body length 2710. General coloration pale.

Head (Fig. 1). Length *ca*. 1.16 x its width (1.16 ± 0.06; n = 18). Interocular suture not united with antennal suture. Ratio between lengths: clypeus/head: 0.39 (0.39 ± 0.015; n = 19); eye/head: 0.43 (0.42 ± 0.02; n = 20); labrum-epipharynx/head: 0.5 (0.5 ± 0.02; n = 19); labrum-epipharynx/AIII: 0.9 (0.84 ± 0.04; n = 4). Antennal formula AIII-AXV 2; AXVI 0 (Fig. 7). AIII with external ascoid implanted more apically than the internal one (in some paratypes, the internal and external ascoids are situated on the same level). Ascoids in AIV simple, without proximal prolongation and the distal one not reaching the middle of the segment (Fig. 5). AV (Fig. 6) without papilla (presence in four paratypes; n = 34). AXIII without papilla. Palpal formula: 1.2.3.4.5. Palpomere II without Newstead's spines. Palpomere III (Fig. 8) with Newstead's spines implanted in the basal third of the segment and one apical seta. Cibarium (Fig. 9) with long chamber, with only rudimental lateral teeth; lacking the pigmented patch and posterior bulge; complete arch. Pharynx without developed teeth. Labium (Fig. 3): sutures forming a labial furca. (See measurements in the Table 1.).

Cervix. Ventrocervical sensillae present.

Thorax. Presence of 3, 5 proepimeral bristles (paratypes: 2-6; n = 22). One upper anepisternal bristle (0-3; n = 22). One posalar bristle (1-2; n = 22). Paratergital bristles absent (1 in two paratypes). Setae on the anterior katepisternum edge present. Suture between katepimeron and metepisternum well defined and long. Wing as in Fig. 15. (See measurements in the Table 1).

Abdomen. 1700 long (1664 ± 169; n = 20). Tergites III-VII with tergal papillae. Terminalia (Fig. 18): gonostyle length 133 (133 ± 7; n = 20) with five well developed spines, two apical; the upper external inserted subapically; the lower external on the 4th apical; the internal in the middle of the structure. Gonocoxite length 250 (250 ± 14; n = 20) maximum width 45 (46 ± 5; n = 20), with 9-10 isolated bristles (7-14; n = 34). Paramere simple, dorsal margin length 170 (165 ± 11; n = 20), the ventral margin length 178 (185 ± 11; n = 20) with setae implanted beyond the middle. Lateral lobe length 228 (220 ± 22; n = 20); width, measured in the middle of the structure, 25 (25 ± 2; n = 20). Aedeagus (Fig. 19): conical, dorsal margin length 135 (128 ± 9; n = 20), ventral margin length 85 (77 ± 8; n = 20). Genital pump length 125 (118 ± 6; n = 20); piston length 100 (92 ± 5 n = 20); chamber length 18 (19 ± 2; n = 20). Genital filaments length 380 (356 ± 28 n = 20) or 3.04 times length of genital pump; tip of genital filaments simple (Fig. 19).

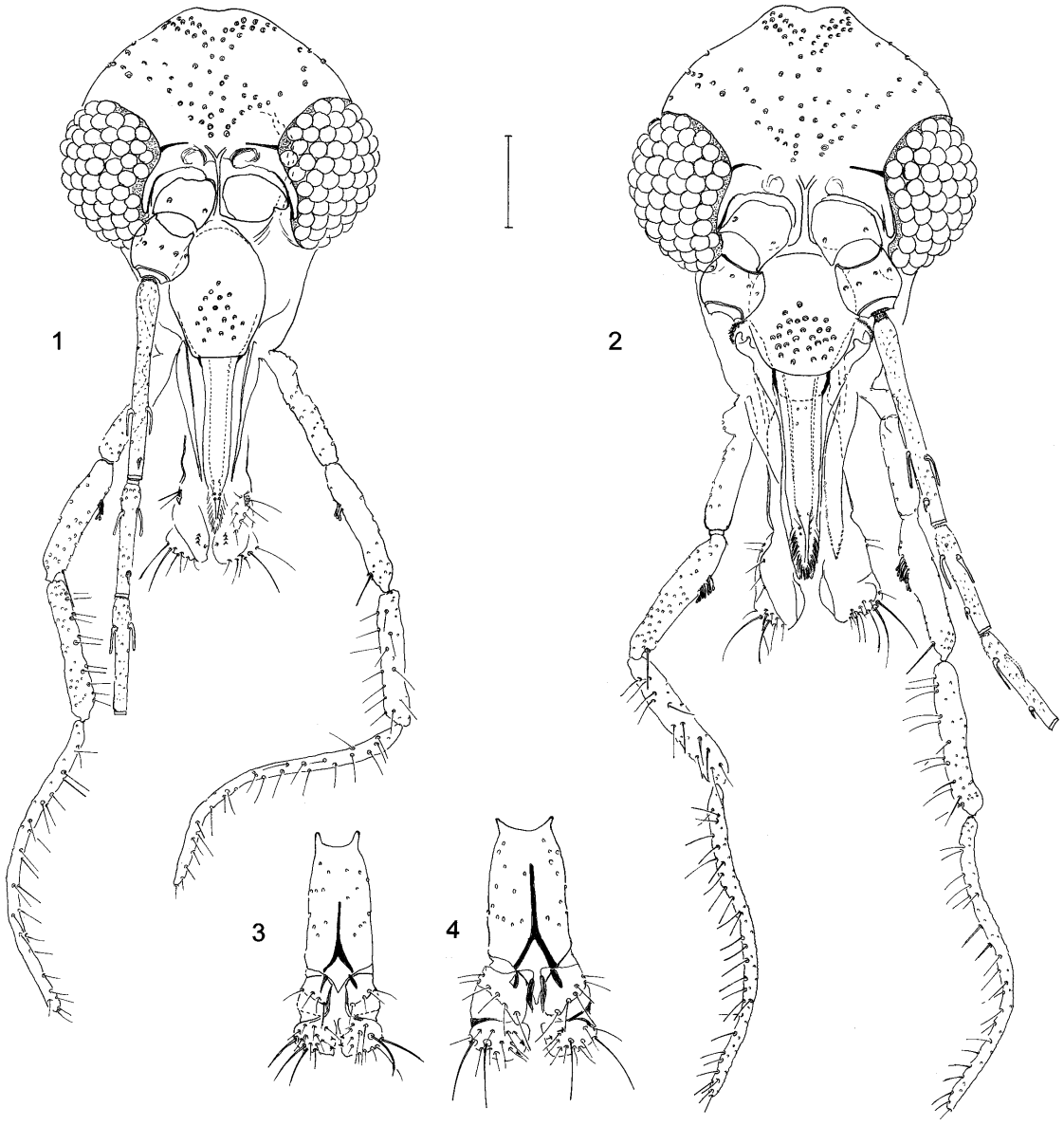
Allotype. Total body length 2920 (2820 ± 230; n = 9). General coloration pale.

Table. 1. Measurements (in μm) of the head and thorax of holotype, allotype and paratypes of *Edentomyia piauiensis* **sp. nov.**

Characters	Hol. male	Paratype males			Allo.	Paratype females		
		N	Mean	SD		N	Mean	SD
Head: length	370	19	362	23	392	9	379	19
width	320	18	314	22	360	9	350	19
interocular distance	123	17	115	24	152	9	145	10
clypeus	143	20	143	9	130	9	136	7
eyes: length	160	20	150	12	175	9	169	12
width	105	20	98	12	102	9	103	10
Labro-epipharynx	185	20	180	11	208	9	203	11
Antenna: AIII	205	4	227	5	232	3	214	23
AIV	115	4	124	4	122	3	115	9
AV	125	3	130	2	120	3	115	9
AXV	50	1	65	-	...	2	54	4
AXVI	60	1	63	-	...	2	54	0
Palpomere I	35	17	34	3	40	8	39	4
II	95	15	94	11	105	8	104	5
III	145	15	135	10	152	6	151	10
IV	148	14	149	9	167	6	165	7
V	328	13	328	44	330	6	341	48
Mesonotum length	460	20	470	47	600	9	560	58
Wing: length	1830	19	1814	128	2070	9	1991	141
width	540	19	550	45	690	9	628	52
alpha	320	19	307	24	400	9	340	52
beta	200	19	204	25	200	9	243	26
gamma	280	19	265	367	340	9	328	30
delta	70	19	73	21	110	9	66	20
R5	1040	19	1060	80	1290	9	1248	112
Femur: anterior	660	12	651	53	770	4	735	77
median	650	5	642	64	770	3	720	87
posterior	730	7	757	63	880	4	843	82
Tibia: anterior	970	12	962	84	1050	4	1038	105
median	1120	4	1058	84	1210	3	1177	153
posterior	1200	8	1270	134	1410	4	1370	154
Tarsomere I: anterior	590	11	576	39	590	4	623	57
median	710	3	610	40	675	3	651	67
posterior	720	3	750	20	770	4	798	92
Tars. II+III+IV+V: anter.	640	7	659	31	710	4	710	65
median	650	3	660	53	740	2	770	14
post.	700	2	755	21	790	4	799	97

SD = Standard Deviations

Head (Fig. 2). Length 1.09 x its width (1.08 ± 0.04; n = 9). Interocular sutures not united with the antennal suture. Ratio between lengths: clypeus/head: 0.33 (0.36 ± 0.01; n = 9); eye/head: 0.45 (0.45 ± 0.04; n = 9); labrum-epipharynx/head: 0.53 (0.54 ± 0.01; n = 9); labrum-epipharynx/AIII: 0.9 (0.96 ± 0.04; n = 3). Antennal formula AIII-AXV 2; AXVI 0 (observed in two paratypes). AIII with external ascoid implanted more apical than the internal one. Ascoids in AIV without proximal prolongation; apical one reaches middle segment (Fig. 10). AV with papilla (Fig. 11). AXIII damaged in the allotype, but without papillae in two paratypes. Palpal formula: 1.2.3.4.5. Palpomere II without Newstead's spines. Palpomere III (Fig. 12), with Newstead's spines in the basal third of the segment and one apical seta. Cibarium (Fig. 13) with long chamber having no anterior or posterior teeth, only lateral teeth; pigmented patch and posterior bulge absent; arch complete (Fig. 14 - paratype). Pharynx without developed teeth. Labium (Fig. 4) with sutures forming the labial furca. Maxilla: lacinia with 6 external teeth (5-8; n = 10) disposed in longitudinal row with 17, 20 internal teeth (17-21; n = 10). Hypopharynx with *ca*. 20 deep apicolateral teeth.



Figs. 1-4. *Edentomyia piauiensis* **sp. nov.** Holotype, male and allotype: **1**, head, male; **2**, head, female; **3**, labium, male; **4**, labium, female. Bar = 100µm.

(See measurements in the Table 1).

Cervix. Ventrocervical sensillae present.

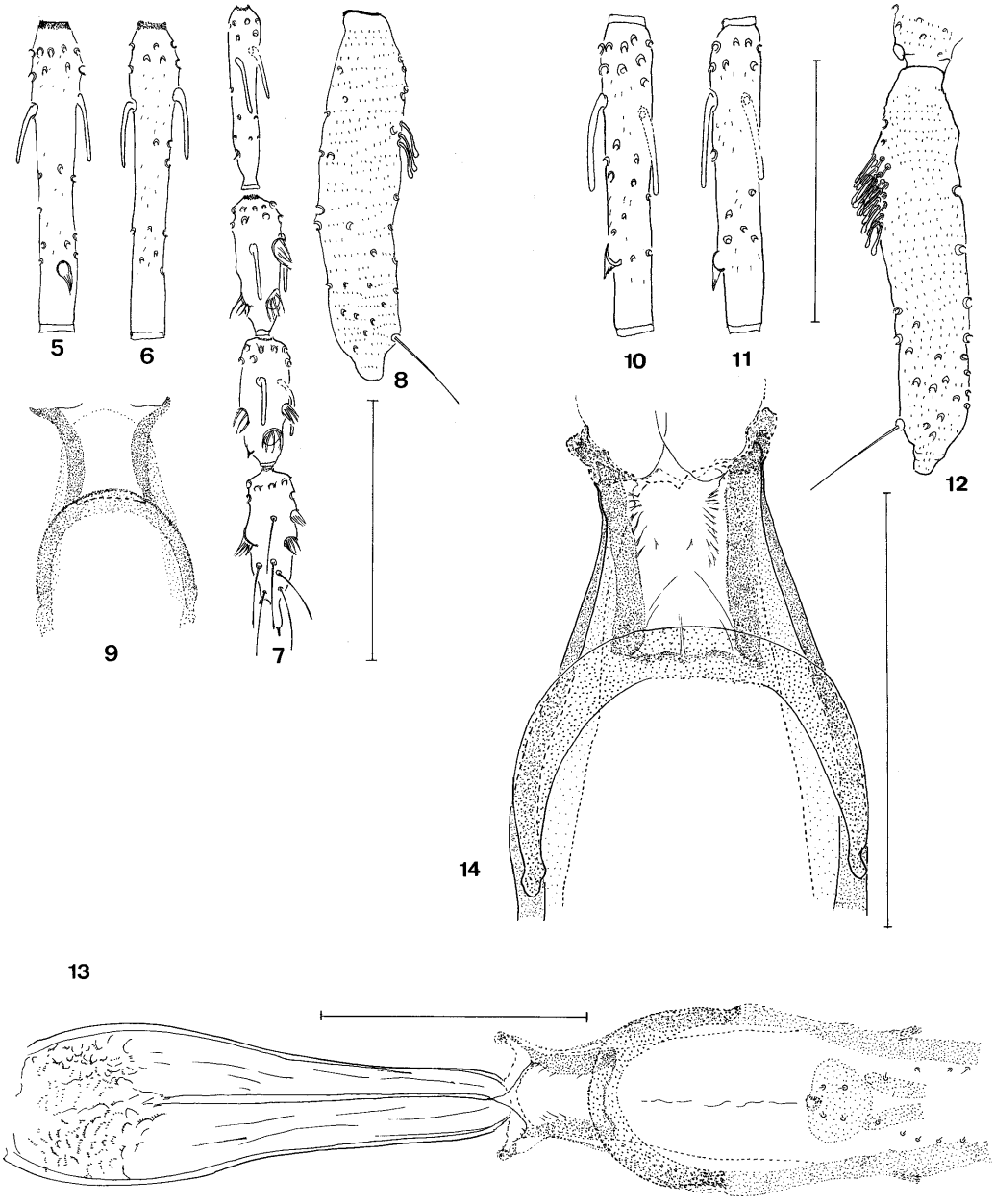
Thorax (Fig. 17). Presence of 3 proepimeral bristles (paratypes: 1-3; n = 9). Five and seven upper anepisternal bristles (3-7; n = 9). Two posalar bristles (1-2; n = 9). Paratergital bristles absent (1, in three paratypes). Setae on the anterior katepisternum edge present. Suture between katepimeron and metepisternum well defined and long. Wing as in Fig. 16. (See measurements in the Table 1.).

Abdomen length 1900 (1854 ± 164; n = 9). Terminalia: tergite VIII without bristles. Spermathecae (Fig. 20) length 33 (36 ± 5; n = 9) and maximum width 12 (10 ± 1; n = 9) with 8 (7-11; n = 7) segments; individual duct length 137 (134 ± 12; n = 9), maximum width 5 (4 ± 1; n = 9); common duct length 23 (32 ± 7; n = 9) and maximum width 10 (8 ± 2; n = 9). Cercus simple, 158 long (169 ± 8; n = 9).

Material examined. Holotype male. BRAZIL, Piauí State, Picos county, Cristovinho district, Cristovinho's cave, 30/31.X.2000. A. C. L. Silva col. (CPqRR). Allotype and paratypes: same data of holotype: 20 males and 3 females (CPqRR); 15 males, 3 females (FSP); 5 males, 2 females (IOC). 28 males, 14 females, 2/3.XI.1999, A. C. L. Silva col. (CPqRR).

Remarks. The type locality: Cristovinho's cave which is about 4 km north from the town of Picos (North: 9 217 019.26 UTM, East: 227 485.23 UTM), in the eastern region of Piauí State, has a main entrance 20 m wide x 15 m high and is inhabited by bats.

Other localities of Piauí State where specimens of this new species have been captured: Piracuraca county (North: 9 565 364.63 UTM, West: 199 137.79 UTM)- Parque Nacional de Sete Cidades; Castelo do



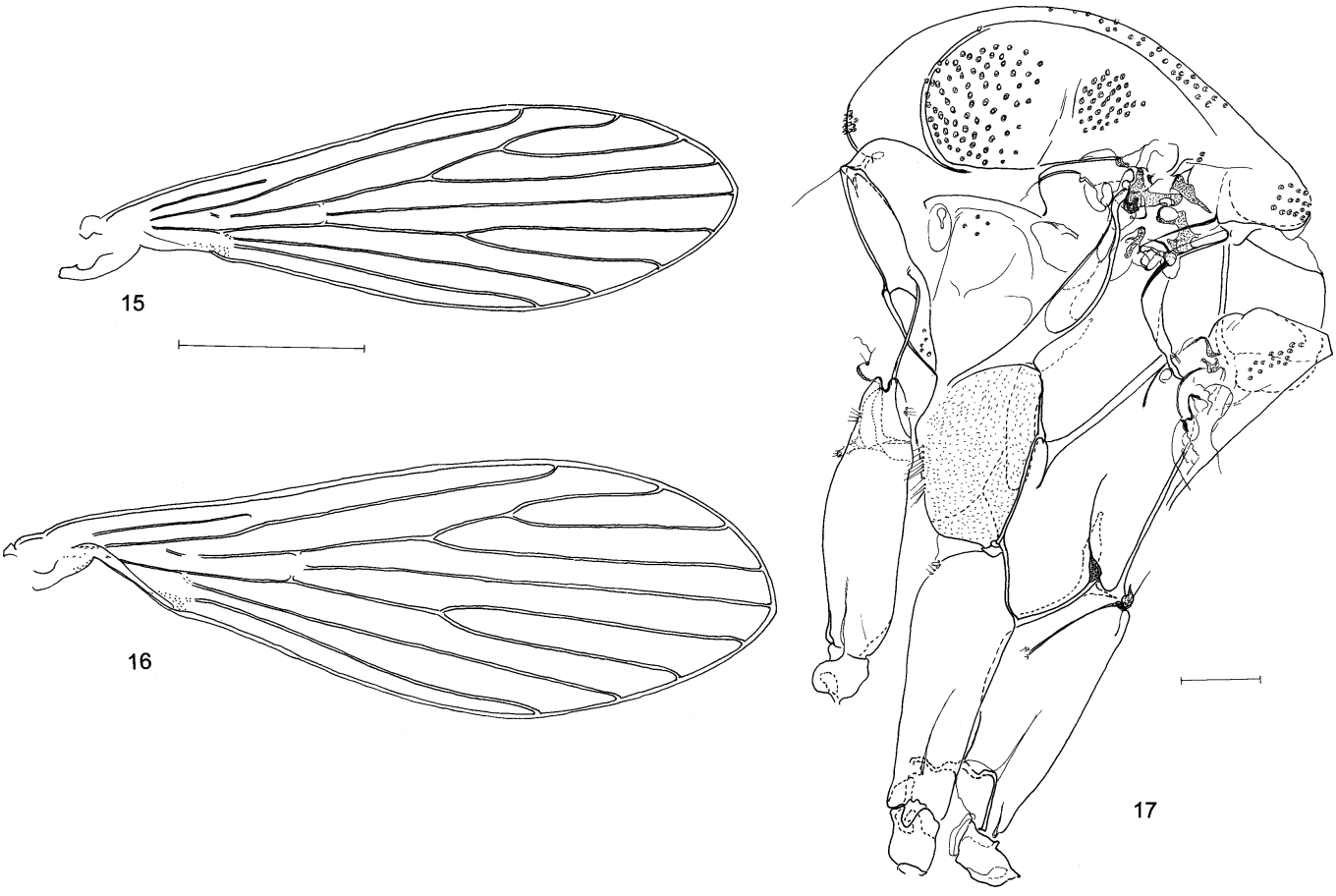
Figs. 5-14. *Edentomyia piauiensis* **sp. nov.** Holotype, male: **5**, antennomere IV; **6**, antennomere V; **7**, antennomeres XIII-XVI; **8**, palpomere III; **9**, cibarium. Females. **10-13**, allotype: **10**, antennomere IV; **11**, antennomere V; **12**, palpomere III; **13**, cibarium; **14**, paratype: cibarium. Bars = 100 μm.

Piauí county (North: 9 411 345.82 UTM, East: 217 093.42 UTM) - Pedra do Castelo; São Raimundo Nonato county (North: 9 002 659.31 UTM, East: 752 918.63 UTM)- Parque Nacional da Serra da Capivara (in cave).

TAXONOMIC DISCUSSION

According to GALATI (1995) the tribe Phlebotomini is distinguished from the Hertigiini by the apomorphies: the presence of proepimeral bristles; bristles covering the tergites arranged without forming transversal bands; cerci shorter than lateral lobes and absence of intra-abdominal rods. In the Phlebotomini, Australophebotomina, Brumptomyiina, Sergentomyiina, Lutzomyiina and Psychodopygina form a monophyletic group supported by a single synapomorphy represented by the presence of horizontal (anterior and/or posterior) teeth in the cibarial armature. The synapomorphies that distinguish the four latter subtribes of Australophlebotomina are represented by the presence of upper anepisternal bristles and tergite IX lacking a single sclerite at its base, i. e. completely modified in two lateral lobes

However, in *Edentomyia piauiensis* **sp. nov.** the presence of upper anepisternal setae and cibarium without anterior and



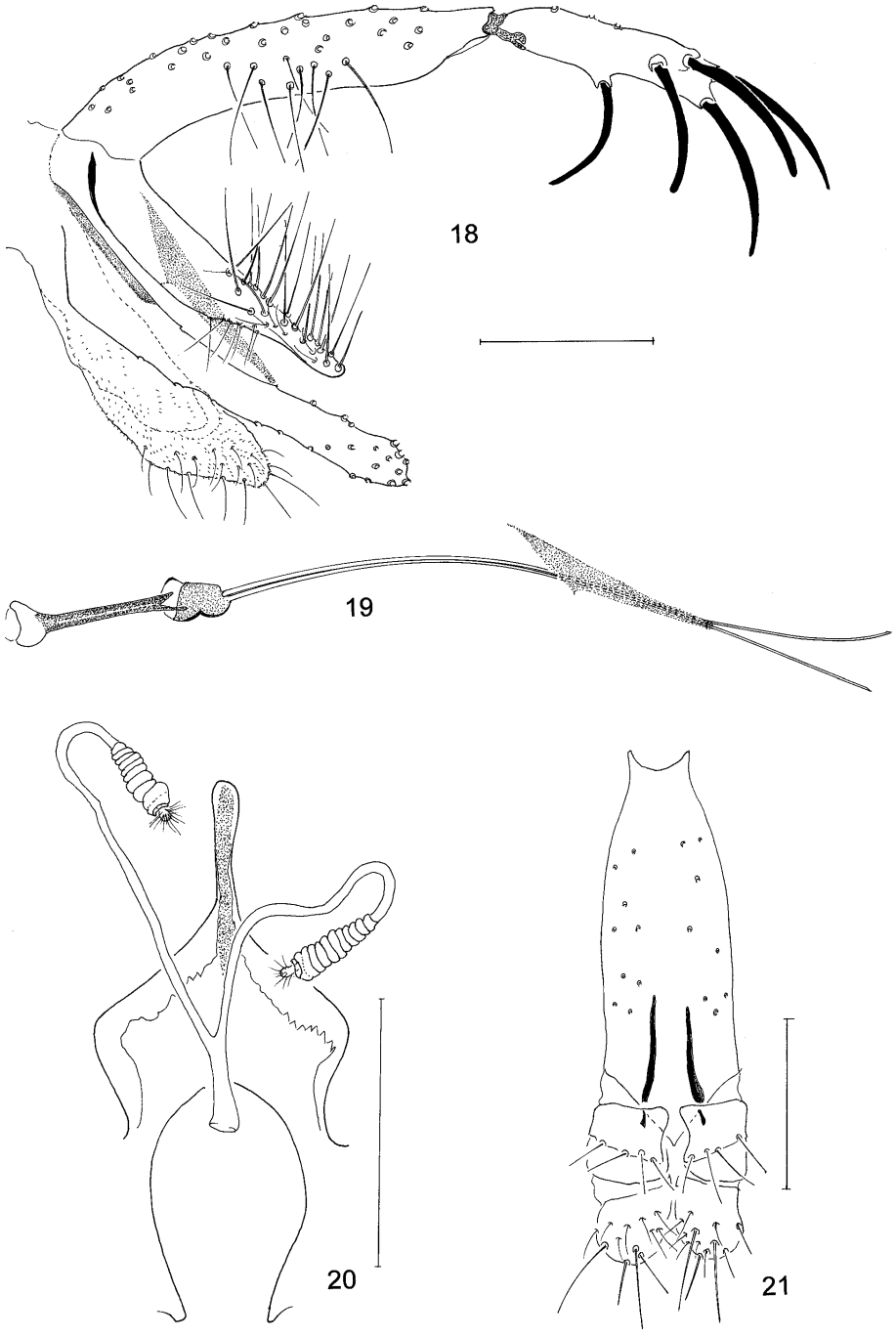
Figs. 15-17. *Edentomyia piauiensis* **sp. nov.** Wings. **15**, holotype, male; **16**, allotype. Bar = 500 µm. Thorax. Allotype, female. Bar = 100 µm.

posterior teeth raise some questions concerning its classification: 1) Does the absence of these bristles in Phlebotomina and Australophlebotomina signify the loss of these structures? Or, in fact, did they appear only in the ancestor of the subtribe Bumptomyiina+, as considered in GALATI'S (1995) classification? 2) Did the arrangement of horizontal teeth in the Australophlebotomina's cibarium arise independently of the Brumptomyiina+? Or did it occur as a single event, as considered in this classification? If this last event did in fact take place, it seems reasonable to suppose that the first alternative to question 1 also occurred, i. e. the upper anepisternal bristles arose in the ancestor of Phlebotomina+ and were lost in Phlebotomina and Australophlebotomina.

As a second supposition, the absence of teeth in the cibarium of this new taxon may be a loss, hence an apomorphy, as suggested by HENNIG (1972) for *Warileya, Hertigia* and *Phlebotomus*. He also suggested that the loss of mandibles among males and the concomitant atrophy of the cibarium supported this view. However, it may be concluded from an examination of the male cibarium that the atrophy did in fact occur, but maintained some similarity to that of the females, i. e. with only horizontal, vertical and lateral vestigial teeth. Further, the presence of lateral teeth alone in the sandfly *Chinius,* with many plesiomorphies, and in Sycoracinae, another subfamily of Psychodidae, with mouthparts of females adapted for sucking blood, at least in some genera (YOUNG, 1979), is an argument that favours the later appearance of horizontal teeth as an apomorphic state of the character. RISPAIL & LÉGER (1998) argue that the development of the simple cibarial armature into a later well-developed one, may suggest an adaptive character.

Other aspects of the cibarium of *Edentomyia piauiensis* **sp. nov.** such as the complete arch, the absence of the pigmented patch and posterior bulge, as occurs in Hertigiina, Phlebotomina and in Bruchomyiinae, the sister-group of Phlebotominae, indicate that the absence of the cibarial armature is a plesiomorphy.

Taking the cibarium of the *Edentomyia piauiensis* **sp. nov.** as being the plesiomorphic state and that the upper anepisternal bristles arose in the ancestor of Brumptomyiina+, then the placing of this new taxon in GALATI'S (1995) cladogram, would precede the position of this subtribe. In this case, the presence of horizontal teeth in the cibarium of Australophlebotomina would represent a convergence, implying that the monophyletic branch formed by this subtribe and Brumptomyiina+ would be, in fact, a polyphyletic group and hence undesirable in phylogenetic classification.



Figs. 18-21. *Edentomyia piauiensis* **sp. nov.** Holotype, male: **18**, terminalia; **19**, aedeagus, genital pump and filaments. Allotype female: **20.** Genital fork and spermathecae. **21**, *Deanemyia samueli* (Deane, 1955). Labium. Bars = 100 µm.

If the development of the horizontal teeth was a single event, it is then possible that the upper anepisternal bristles arose in the ancestor of Phlebotomina+ and were lost independently in this subtribe and in Australophlebotomina. The small number of these bristles in *Edentomyia piauiensis* **sp. nov.**, sometimes absent in the males, reinforces this point of view.

As a third hypothesis, it may be thought that the upper anepisternal bristles arose early in Diptera and were maintained in a polymorphic condition in several families, including the Psychodidae. In this family these bristles are present at least in some genera of all Neotropical subfamilies: Bruchomyiinae, Phlebotominae, Psychodinae, Sycoracinae and Trichomyiinae. Hence, this polymorphic condition would have occurred prior to the division of the ancestral species of Bruchomyiinae and Phlebotominae and cladogenetic events occurred which split this species into two or more, without the fixation of this mutation either in the ancestor, or in its descendant species. The ancestral species of Hertigiini and that of Australophlebotomina

lost this apomorphic allele, but in the ancestor of Phlebotomina+ retained the polymorphic condition, which was also preserved in Phlebotomina and Sergentomyiina. Thus the latters' descendants may or not present these bristles. On the other hand, Brumptomyiina and the ancestor of Lutzomyiina and Psychodopygina preserved the apomorphic state only, with the elimination of the plesiomorphic allele. So the presence of these bristles in *Edentomyia piauiensis* **sp. nov.**, in some groups of Sergentomyiina, Brumptomyiina, Lutzomyiina and Psychodopygina may be considered a synapousy, according to the concept introduced by Amorim *et al*. (1993).

Edentomyia piauiensis **sp. nov.** also presents several other characteristics in common with Phlebotomina (or the genus *Phlebotomus*, according to various authors), but many of these are plesiomorphies: palpal formula 1.2.3.4.5, Newstead's spines grouped in the basal half of the palpomere III, presence of ventrocervical sensillae, posalar bristles and setae on the anterior edge of the katepisternum, long suture between katepimeron and metepisternum, gonostyle with five spines, two of them in apical position; simple paramere and conical aedeagus. However, they share a few synapomorphies, such as the arrow-head formation of the occipital bristles, absence of ascoids on AXVI and spermathecae with annuli.

This new taxon, apart from the question of the cibarial armature, may be distinguished from the American subtribes Brumptomyiina, Sergentomyiina, Lutzomyiina and Psychodopygina by the following character. It differs from the Psychodopygina in the presence of posalar bristles, ventrocervical sensillae and palpal formula. From the Sergentomyiina, by having papilla on flagellomere III (AV), mainly in the females. In this subtribe, the new taxon seems to be similar to *Deanemyia* Galati, 1995, but only because of their plesiomorphies, such as the palpal formula, the presence of posalar bristles and setae on the anterior edge of the katepisternum and the long suture between the katepimeron and the metepisternum. However, it is easily distinguished from *Deanemyia* species by the labial sutures, which are not joined in these latter (Fig. 21). The plesiomorphies mentioned have also been found in the species of the genus *Oligodontomyia* Galati, 1995 (Brumptomyiina) (Galati, 1995). In relation to the other genus of this subtribe, *Brumptomyia*, *E. piauiensis* **sp. nov.** is easily distinguished by the aspect of the ascoids in both sexes and by the terminalia of the males.

The new taxon differs from Lutzomyiina by the palpal formula and presence of posalar setae. Among the genera of this subtribe, *E. piauiensis* **sp. nov.** is closest to *Lutzomyia,* mainly to some species of the subgenus *Lutzomyia*, but can be distinguished from them by the absence of setae on the anterior edge of the katepisternum in the latter.

Consequently, *Edentomyia piauiensis* **sp. nov.** belongs to Phlebotomini, but for its insertion in one or other subtribe or as a new subtribe, further phylogenetic studies are necessary.

The association of the sexes was based on the capture of males and females in the same places and on the agreement of genital and extra-genital characteristics.

Etymology. The species name, *Edentomyia piauiensis,* refers to Piauí State, Brazil.

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